

**REMARKS**

This Amendment responds to the Office Action mailed April 2, 2009. With this amendment, Applicants amend claims 1-3, 6, 12, 14, 16, 21-27, and 29 - 32, and cancel claims 5 and 13. No new matter has been added by the present amendment. Support for the amendment can be found throughout the specification and claims as filed, including, e.g., in previously presented claims 1-32, and in the specification at pages 33, 42, 44-46, and 54, and in Figures 8, 10, 11, and 12. Claims 1-4, 6- 12, and 14-32 are pending and under consideration with this amendment.

**Drawings**

Applicants thank the Examiner for acknowledging the acceptance of the drawings filed September 11, 2006.

**Priority**

Applicants thank the Examiner for acknowledging Applicants' claim to foreign priority based on Japanese Application No. 2004-065839.

**Information Disclosure Statement**

Applicants also thank the Examiner for acknowledging receipt of the Information Disclosure Statement filed on January 10, 2007, and for returning electronically signed copies of the Forms PTO-1449 submitted therein.

**Summary of Amendments**

Applicants note that the current amendment incorporates the feature of claim 5 into claim 1. The amendment to claim 1 further clarifies the present invention, and describes the position of the plurality of unit bodies which are placed vertically and adjacently. Applicants note that claims 5 and 13 have been canceled in order to avoid redundancy. Claims 12, 14, 21, and 31

have been amended to parallel the claim language of claim 1. Applicants further note that the current amendment also corrects minor errors, such as typographical errors.

**Response to Claim Rejections Under 35 U.S.C. § 103**

Initially, Applicants note with appreciation that claim 26 appears to be free from art-based rejections. Accordingly, an indication of allowability is respectfully requested.

The Action rejects claims 1-14, 16-21, 23-25, and 27-30 under 35 U.S.C. § 103(a) as being unpatentable over Shimomura (JP 2001-129345) in view of Szirmay (U.S. Patent No. 4,529,415) and Hashimoto (U.S. Patent Application No. 2002/0015669 A1). The Action also rejects claims 31-32 under 35 U.S.C. § 103(a) as being unpatentable over the combination of Shimomura (JP 2001-129345), Szirmay (U.S. Patent No. 4,529,415), Hashimoto (U.S. Patent Application No. 2002/0015669 A1), and Lovell et al. (U.S. Patent No. 6,719,828).<sup>1</sup> The Action also rejects claims 15 and 22 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Hashimoto.

These rejections are respectfully traversed. Applicants respectfully submit that the cited documents do not teach, singularly or in combination, all the claimed elements of the present invention.

**Szirmay et al.**

Applicants note that Szirmay teaches a method and apparatus for the semi-continuous batch separation of a feed mixture of gaseous products into individual substantially pure products and utilizes preferential adsorption in which all the components of a gaseous feed mixture are adsorbed by one or more adsorbers through which the feed mixture of gaseous products are sequentially cycled through the steps of (1) progressive adsorption of adsorbates from the

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<sup>1</sup> Applicants note that Lovell et al. is cited in the text of the Office Action as U.S. Patent No. 6,477,854 B2, but is correctly cited in the Form PTO 892 as U.S. Patent No. 6,719,828.

mixture of gaseous products; (2) rectification of the adsorbates and (3) desorption of adsorbates contained in the adsorber with the adsorber being readied for further adsorption. Substantially pure gases are collected at appropriate intervals throughout the sequential cycling.

Szirmay also discloses “[a] rectifying gas or agent is then introduced into the feed end of the adsorber using the second introduction means, and gaseous products withdrawn from the adsorber until the most adsorbable gaseous product appears in the effluent from the adsorber in a desired significant quantity whereupon flow of the rectifying agent is discontinued. The rectifying agent can be the gas in the feed mixture having the highest adsorbability in the adsorbent used” in column 3, lines 3-9. Also, in column 3, lines 27-30, Szirmay teaches “[w]here three or more adsorbers are utilized, the first, second, third, and where appropriate, readying means of each adsorber are respectively arranged with corresponding means of the remaining adsorbers to utilize common headers or supply piping. The corresponding withdrawal means are likewise arranged with headers and to utilize respectively, a single analyzer means for each header.”

Shimomura et al.

Applicants note that Shimomura teaches an active carbon absorbent tower and the tower removes odorous gases in gas mixtures and according to the description in Shimomura in paragraph [0020] and Figure 1, the tower removes the odorous gases by introducing the odorous gas to the intake chamber 8 from the gas inlet port 2 to attain uniform pressure and then passes through the opening 12 and the gas intake opening 16 and flows into the intake duct 20 of the lower cartridge 5. The part of the odorous gas passing through the gas bypass opening 21 flows into the gas inlet room 29 and the odorous components of the gas are absorbed by passing

through the active carbon layer 26 and then, the odorless processed gas is discharged to the exhaust duct 22 through the opening 23 for raw gas unification.

Hashimoto et al.

Hashimoto teaches, in paragraph [0006], an exhaust emission control system that can accurately estimate the amount of sulfure oxide absorbed in the NOx removing device to thereby execute the regeneration process for the sulfur-poisoned NOx removing device at optimum timing.

Lovell et al.

Applicants note that Lovell. discloses an absorbent for removing mercury from flue gas, and is not drawn to removing nitrogen oxide. Further, Lovell et al. discloses nitrogen oxide as a test gas to assist in the uptake of mercury (Lovell et al., abstract, and column 26, lines 37-45).

The Present Invention

Applicants note that the present invention is directed to “[a] nitrogen oxide removal equipment for removing nitrogen oxide contained in gas, comprising: a nitrogen oxide absorption means provided with an absorption unit for removing nitrogen oxide contained in said gas by passing said gas through a solid absorbent layers, said absorption unit comprising: an absorbent storage part surrounded by a boundary wall of a storage part, a bottom panel of a storage part, and an upper portion of an outlet side, and provided with said solid absorbent layers therein; and a plurality of low-profile unit bodies being placed vertically and adjacently and being provided with a gas rectification part in which gas is caused to pass through said solid absorbent layers, and said unit body comprising: an intake side surface; an outlet side surface disposed opposite to said intake side surface and provided with said upper portion of said outlet side and a lower portion of an outlet side; said storage part boundary wall disposed between said

intake side surface and said outlet side surface; said bottom panel of said storage part disposed horizontally from a lower end of said boundary wall of said storage part to said upper portion of said outlet side; a bottom of said rectification part disposed below a boundary of an outlet side, said boundary including a boundary between said upper portion of said outlet side and said lower portion of said outlet side; a bottom panel of said intake side extending from said intake side surface to said bottom of said rectification part; and a bottom panel of said outlet side extending from said boundary of said outlet side to said bottom of said rectification part, wherein a ratio of A:B is in a range of 1:1 to 1:10, where A represents a distance from a boundary defined by said bottom of said rectification part and said bottom panel extending to said outlet side to said bottom panel of said storage part while B represents a distance from said boundary to said outlet side surface, said boundary being placed near to said intake side surface while said bottom of said rectification part extending so as to be aligned to said boundary wall of said storage part of another unit body at said intake side."

Applicants submit that the present invention possesses features that provide improvements over the prior art and the cited documents. In particular, Applicants note that the present invention includes the following features:

a plurality of low-profile unit bodies being placed vertically and adjacently and being provided with a gas rectification part in which gas is caused to pass through said solid absorbent layers, and ...

wherein a ratio of A:B is in a range of 1:1 to 1:10, where A represents a distance from a boundary defined by said bottom of said rectification part and said bottom panel extending to said outlet side to said bottom panel of said storage part while B represents a distance from said boundary to said outlet side surface, said boundary being placed near to said intake side surface while said bottom of said rectification part extending so as to be aligned to said boundary wall of said storage part of another unit body at said intake side.

Applicants note that the features recited above improve the rectification effect for air passing through the rectification part by regulating the low-profile feature of the form of the unit

body together with the rectification part for attaining the smooth and a generally flat gas inlet leading and directing the gas mixture to the absorbent storage part evenly, as inherently results from the relationships defined in the claims.

Applicants further note that the present invention removes low concentration nitrogen oxides in a gas in low concentration as low as a few parts per million (ppm). The nitrogen oxides in the gas are sometimes difficult to remove from the gas mixture as a result of the low absorption efficiency; however, the nitrogen oxide removal equipment has quite high efficiency to remove any kind of oxides.

Applicants note that in order to attain the aforementioned improvements, the equipment could use sensitive absorbents which loses their absorption performance according to the processing time duration and could introduce the gas mixture to the storage part with the even rate to ensure local degradation of the absorbent. If this even and smooth introduction of the gas mixture were attained, the local degradation of the high sensitive absorbent would occur and then the performance of the equipment degrades. This degradation would require maintenance of the equipment, which could become costly when maintenance is required frequently. Applicants note that as a result of the absorption target to low concentration nitrogen oxides and high absorption efficiency, the present invention has easy maintenance.

In order to improve the above aspects of the equipment, the present invention adopts a generally flat-shaped bed and provides the property of the low-profile property as  $A:B = 1:1 - 1:10$  as well as vertical positioning of the rectification part, as inherently results from the relationships defined in the claims. As described above, the absorbent removes the low concentration of nitrogen oxides when passing through the absorbent layer and if the absorbent layer becomes thicker, then the conductance for passing through the absorbent layer becomes

low. The low conductance of the absorbent layer makes the total processing volume per unit time low and then the total performance of the equipment goes low. As previously mentioned the absorbent degrades with respect to the processing history of the gas mixture and must be subjected to maintenance such as regeneration or absorbent replacement. With the present invention, the maintenance of the absorbent is made on site where the equipment is placed, without any disruption in the removal process. In order to attain the on-site maintenance, the present invention utilizes regeneration of the absorbents by washing the absorbents by the regenerant as described in the specification in paragraph [0087].

The low-profile aspect of the present invention reflected in the claims also provides advantages for the regeneration process; the absorbent layer becomes thicker and the conductance for the regenerate also becomes larger so that the regenerant passing through the absorbent layer per unit time becomes low and then the regeneration process speed decreases. As described above, the low-profile aspect of the invention, cooperatively improves the processing efficiency and processing capacity for the nitrogen oxide removal process while saving maintenance costs while assuring continuous operation of the removal process

With regard to the Action's rejection, Applicants respectfully disagree with the Action's determination regarding obviousness. In response, Applicants submit that a *prima facie* case of obviousness has not been established, particularly because there is (1) no showing that the combination of documents teaches or suggests every element of the claims, (2) no reason to modify the document teachings to arrive at the claimed invention, and (3) no showing of a reasonable expectation of success in combining the teachings of the documents.

***The Cited Art Fails to Teach or Suggest the Elements of the Claims***

Applicants submit that the cited documents fail to teach or suggest the elements of the present invention. Applicants note that claims 1-3, 6, 12, 14, 16, 21-27, and 29-32 have been amended, and claims 4, 7-11, 15, 17-20, and 28 depend from those claims. Therefore, Applicants submit that at least with respect to the noted claims, the cited documents fail to teach or suggest all the elements of the present invention.

Applicants further submit that none of the cited documents teaches or suggests the claims of the present invention. Applicants note, for example, none of the documents teaches or suggests a rectification part, as claimed in the present invention. Applicants further note that Szirmay teaches a method and apparatus for separating gaseous mixture, utilizing a rectifying agent and also teaches a plurality of absorbers. Specifically, Szirmay describes the discontinuation of a rectifying agent flow, and fails to teach the practical part of the equipment, which is disclosed in the present invention – a rectification part. Applicants also note that none of the teachings of Szirmay can act as the rectification part of the present invention, nor does Szirmay suggest replacement of the rectification part disposed to the nitrogen oxide removal equipment and formed by juxtaposition or lamination of the adjacent unit body.

With regard to Shimomura, Applicants note that Shimomura, as admitted by the Office, fails to disclose a rectification part in which gas is caused to pass through said a solid absorbent (see Office Action, page 3). Further, Shimomura discloses a gas bypass opening 21 having the function of bypassing but not the function for rectification for directing the gas to be processed toward the absorbent layer. As shown in Figure 1 of Shimomura, the gas bypassed by the gas bypass opening 21 is merely directed to horizontal direction and then the gas bypassed to the horizontal direction and then the gas bypassed to the horizontal direction may be flown into the



lower cartridge 5 as the gas goes into the horizontal space to cause uneven absorption along with the horizontal direction and also to cause uneven degradation of absorbent. Then the Shimomura's gas bypass opening 21 cannot act as the rectification part of the present invention and Shimomura does not suggest the rectification part of the present invention.

Applicants note that Hashimoto teaches a regeneration process of the NOx removing device and its timing; therefore, Hashimoto cannot teach the present nitrogen oxide removal equipment with the low-profile aspect unit body while providing the rectification part for the gas flow of the present invention. Applicants also note that Lovell et al. fails to teach a rectification part.

Applicants submit that in alone or in combination, Shimomura, Szirmay, Hashimoto, and/or Lovell et al. do not teach all the elements of the claimed invention.

***There is No Reason to Modify or combine the Documents Teachings***

Applicants respectfully submit that there is no reason to modify or combine the teachings of Shimomura, Szirmay, Hashimoto, and/or Lovell et al. to arrive at the presently claimed invention. While the *KSR* court rejected a rigid application of the teaching, suggestion, or motivation ("TSM") test in an obviousness inquiry, the Court acknowledged the importance of identifying "a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does" in an obviousness determination. *Takeda Chemical Industries, Ltd. v. Alphapharm Pty., Ltd.*, 492 F.3d 1350, 1356-1357 (Fed. Cir. 2007) (quoting *KSR International Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1731 (2007)).

Applicants further submit that the motivation stated by the Office for combining the cited documents would not have prompted a person of ordinary skill in the relevant field to combine

the elements in the way the present invention does. Further, there is nothing in any of the documents to suggest to the ordinary skilled person to modify or combine the documents' teachings.

Applicants note that the Action states that the motivation for combining Szirmay and Shimomura is the "relatively inexpensive method" of employing the rectifying gas or agent disclosed in Szirmay (Office Action, page 3). Applicants respectfully submit the Action's stated motive does not motivate a person skilled in the art to combine Shimomura and Szirmay. Applicants submit that the fact that a rectifying gas or agent is inexpensive does not establish a reason to modify the invention disclosed in Shimomura to include a rectification part. None of the documents states a need to include a rectification part to an invention such as the one disclosed in Shimomura. Moreover, Applicants submit that even if Shimomura and Szirmay were combined, they would not disclose the present invention.

The Action states that Hashimoto discloses a regeneration process, and the motivation for combining Hashimoto with the other documents is "so that the estimation of the amount of sulfur oxide absorbed in the nitrogen oxide (NOx) removing device becomes inaccurate. This causes a problem in that the timing of execution of the regeneration process may deviate from the optimum timing (Hashimoto paragraph 5)" (Office Action, page 10). Applicants respectfully submit that the motivation stated by the Office is rather ambiguous and does not provide an effective motivation to combine the documents. Applicants further submit that the regeneration process disclosed in Hashimoto does not resolve the sulfur oxide problem stated in Hashimoto. Instead, the invention of Hashimoto, the exhaust emission control system, which accurately estimates the sulfur oxide absorbed in the NOx removing devices, solves the stated problem. Therefore, there is no reason disclosed in Hashimoto to combine a regeneration process with an

invention such as the one disclosed in either Shimomura or Szirmay. Applicants submit that even if Shimomura, Szirmay, and/or Hashimoto were combined they would not disclose the present invention.

Applicants note that the Action states that Lovell et al. discloses nitrogen oxides as a test gas and a water chamber to humidify the test gas, and the reason to combine with the other documents is that Lovell et al. and the other documents are the same field of endeavor (Office Action, page 7). Further, the Action states that the motivation “would have been to provide compositions, processes and systems for removal of heavy metals from gas streams,” (Office Action, page 8) (emphasis added). In response, Applicants note that Lovell et al. is related to an absorbent for removing mercury from flue gas, and is not related to removing nitrogen oxide. In this regard, Lovell et al. discloses nitrogen oxide as a test gas to assist in the uptake of mercury (Lovell et al., abstract, and column 26, lines 37-45). The present invention is drawn to nitrogen oxide removal equipment, which would remove the gas nitrogen oxide, and not to mercury removal or other metals. Applicants submit that there is no reason to combine the teachings of Lovell et al. with the other cited documents. Applicants further submit that even if Shimomura, Szirmay, Hashimoto, and/or Lovell et al. were combined, they would not disclose the present invention.

Applicants respectfully submit that the reasons and motivations stated by the Office for combining the cited documents would not have prompted a person of ordinary skill in the relevant field to combine the elements in the way the present invention does.

***No Reasonable Expectation of Success in Combining the Cited Documents***

Applicants submit that there is no reasonable expectation of success in combining the cited documents. Applicants note that the Action failed to show or even state that there would be

a reasonable expectation of success when Shimomura, Szirmay, Hashimoto, and/or Lovell et al. are combined.

Applicants submit that the improvements of the present invention have been enjoyed through the use of the present invention in Japan for the ventilation system for Tokyo Metropolis Highway Tunnel.

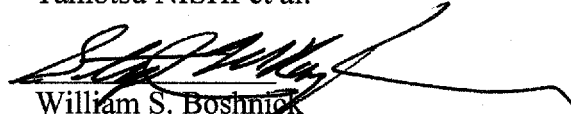
Applicants respectfully submit that a *prima facie* case of obviousness has not been established, particularly because the Office failed to show (1) that the combination of documents teaches or suggests every element of the claims, (2) a reason to modify the documents' teachings to arrive at the claimed invention, and (3) a reasonable expectation of success in combining the teachings of the documents.

In view of the foregoing, Applicants respectfully request withdrawal of the outstanding rejections of claims 1-14, 16-21, 23-25, and 27-30 under 35 U.S.C. § 103, the rejections of claims 15 and 22 under 35 U.S.C. § 103(a), and the rejections of claims 31 and 32 under 35 U.S.C. § 103.

**CONCLUSION**

In view of the foregoing, Applicants respectfully request the Examiner to reconsider and withdraw the rejections of record, and allow all the pending claims.

Respectfully Submitted,  
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